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Safety aspects in the Production and Separation of Hydrogen from Biomass

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SAFETY ASPECTS IN THE PRODUCTION AND SEPARATION OF HYDROGEN FROM BIOMASS

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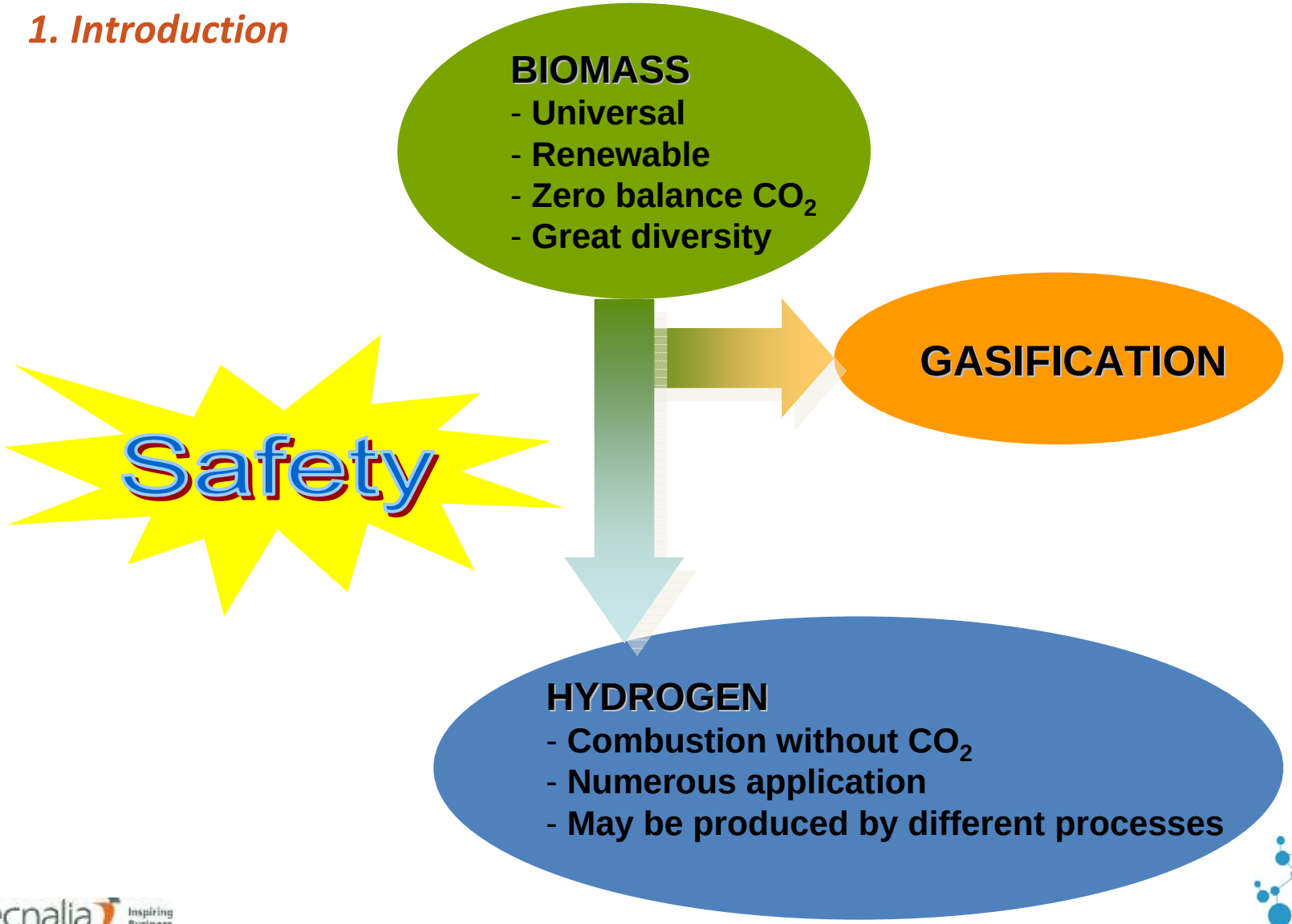
1. Introduction



2. Hydrogen from biomass: the process

GASIFICATION

- Process to obtain a combustible gas from organic solid material

  Biomass ⇨ Gasification ⇨ Syngas (H_2, CO, CO_2, CH_4,..)
- Temperature: 800-950 ºC
- Biomass feeding: 15% HR; 2mm ps
- Substoichiometric conditions
- Gasification agent: air, oxygen or steam
- High efficiencies

Table 1: Synthesis gas composition according to gasification agent.

Gasification agent	Low Calorific Value (Kcal/m^3)	Gas Composition (% vol) Dry based				
		H_2	CO	CO_2	CH_4	N_2
Air	< 1.500	15	15	18	2	50
Steam	3.000-7.000	52	20	22	6	--
Oxygen	3.000-7.000	32	48	15	2	3

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2. Hydrogen from biomass: the process

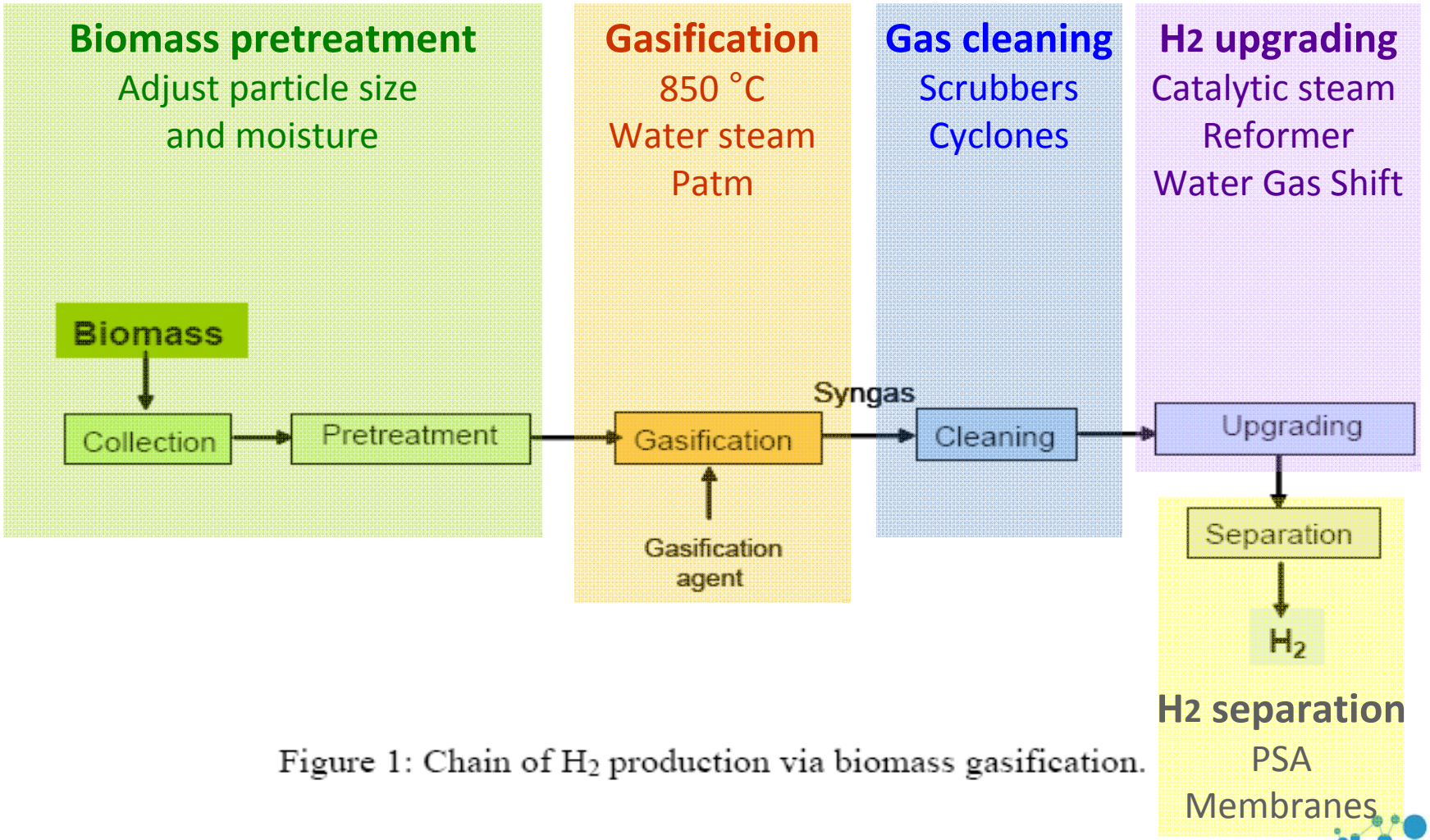

Figure 1: Chain of H_2 production via biomass gasification.

2. Hydrogen from biomass: the process

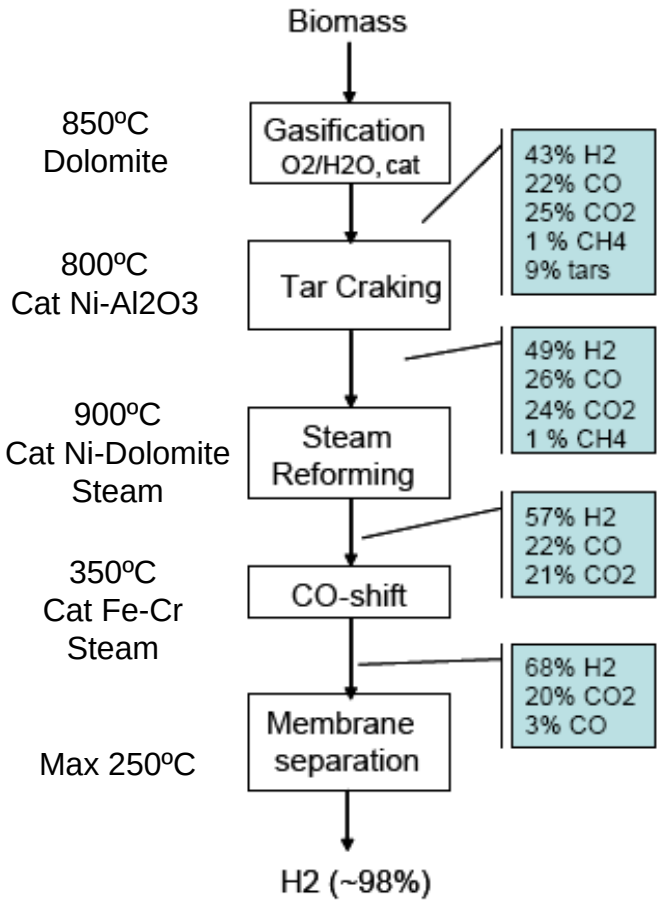

Figure 2: Hydrogen concentration along the process.

Exhaust emissions possibility

Procedure to establish the **technical requirements** and the **recommended practices** to ensure the **highest level of safety**

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3. Safety aspects

Valuable point in the process → Gas Mixtures

Figure 3: Gasification plant of Tecnalia

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Easy ignition

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ATTENTION!!!

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Uncontrolled combustion of hydrogen mixtures

3. Safety aspects

Specific attention to:

- Hybrid mixtures: a combination of a flammable gas and dust
- Ignition sources: sparks
- Product gas from gasification: auto-ignite at temperatures above 600-650°C and in the presence of oxygen

Steam gasification → very limited presence of air

Steam gasification is safer compared with air gasification

4. References

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2. European Project "Guideline for Safe and Eco-friendly biomass gasification". Nov 2009. Intelligent Energy for Europe. EIE-06-078
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